



# NASA Advisory Council Presentation

Dan Dumbacher  
April 2013



# Topics



- Program Status and Schedule
- EFT-1 Update
- ESA Service Module
- Summary
- Quarterly Progress Video



# ESD Status and Schedule

# Orion Accomplishments



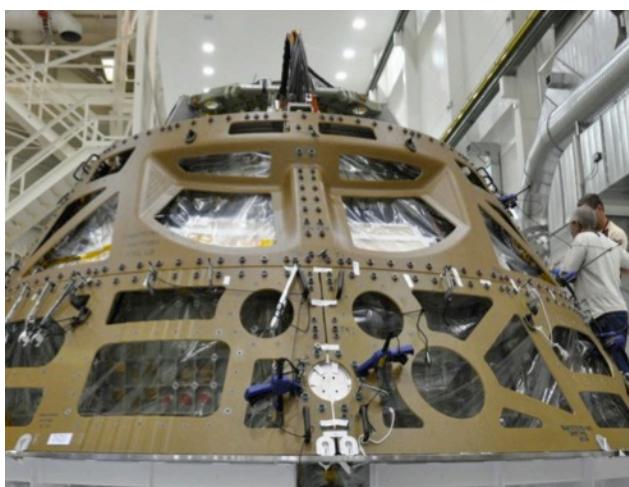
Completed heatshield ready for transport to Textron in Boston, MA for Avcoat application



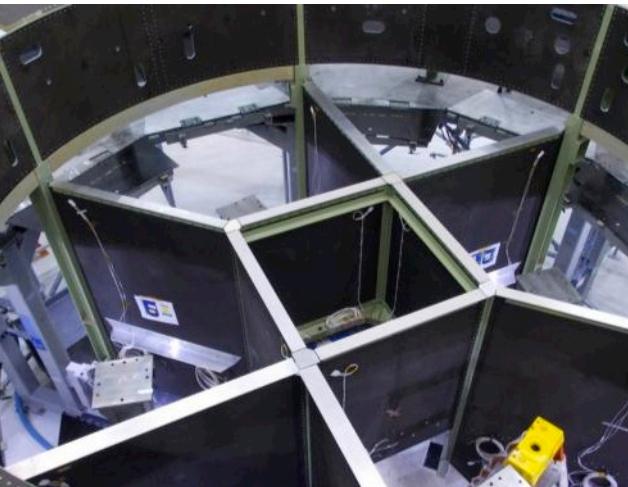
Inert Abort motor delivered to Operations and Checkout Building at KSC



Launch Abort System Ogive panel work at the Michoud Assembly Facility



Backshell panel drilling at the Operations and Checkout Building at KSC

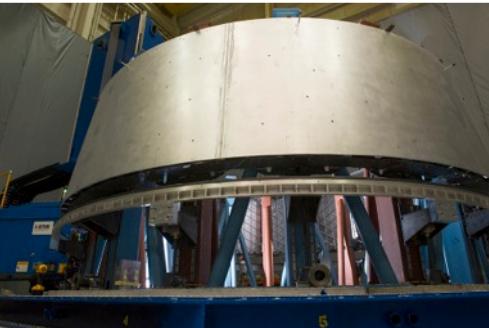


Service module assembly at the Operations and Checkout Building at KSC



Super Guppy carrying the Orion Heat Shield arriving at Hanscom Air Force Base in Boston

# SLS Accomplishments



Systems Engineering & Integration  
SLS model wind tunnel testing at  
Langley Research Center  
Nov 2012

J-2X upper stage engine hot-  
fire test at Stennis Space  
Center  
Feb 2013

Multi-Purpose Crew Vehicle Stage  
Adapter (MSA) Flight Hardware  
at Marshall Space Flight Center  
March 2013

Kennedy Space Center Pad 39B  
(artist's concept) with new  
crawler transporter and control  
room  
Jan 2013



RS-25 Engines at  
Stennis Space  
Center Oct 2012,  
shown with future  
RS-25 Test Stand  
A1



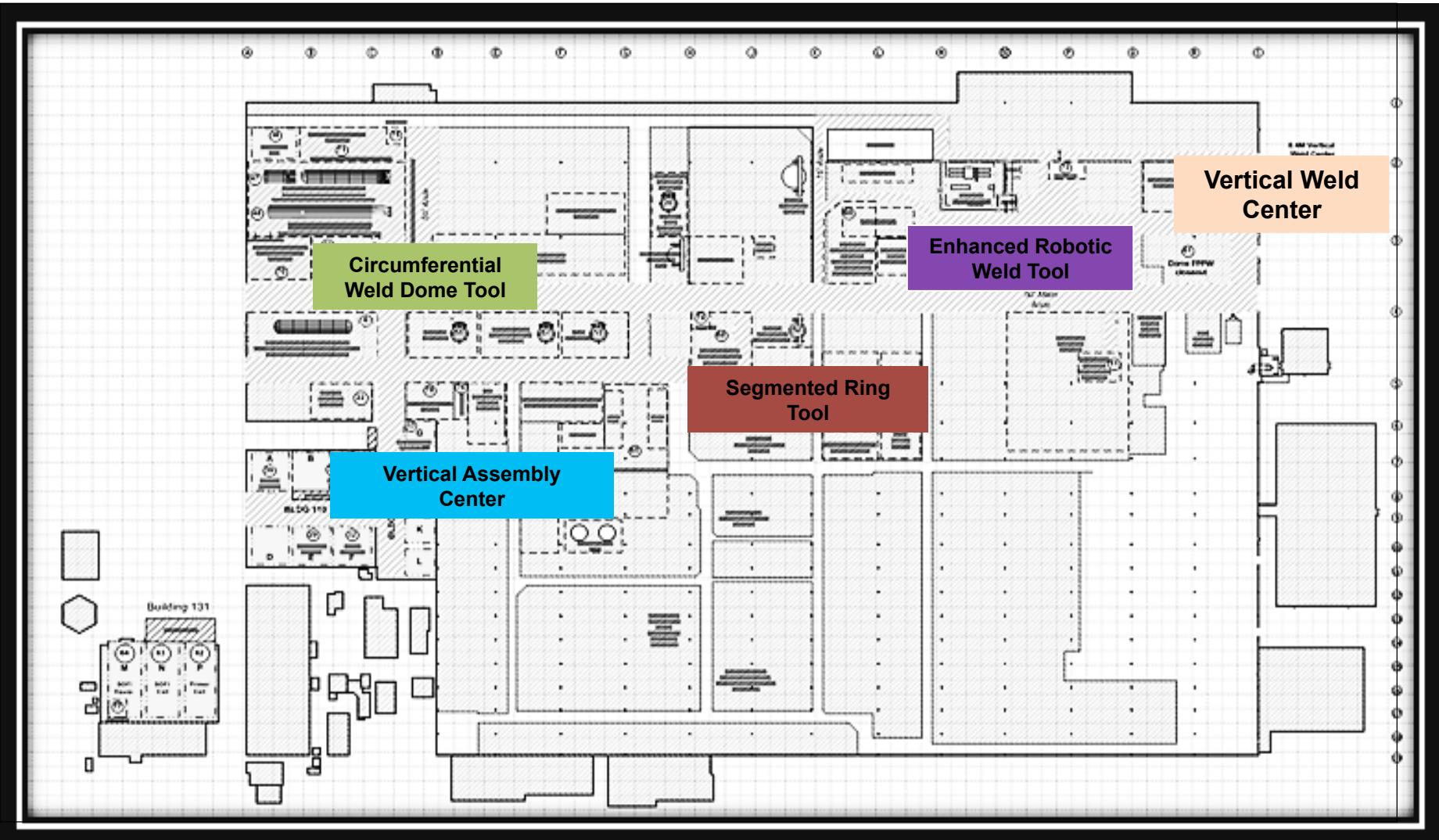
F-1 engine gas generator – technology  
demonstration for an optional Advanced Booster  
concept – hot-fire test at Marshall Space Flight  
Center, Jan 2013



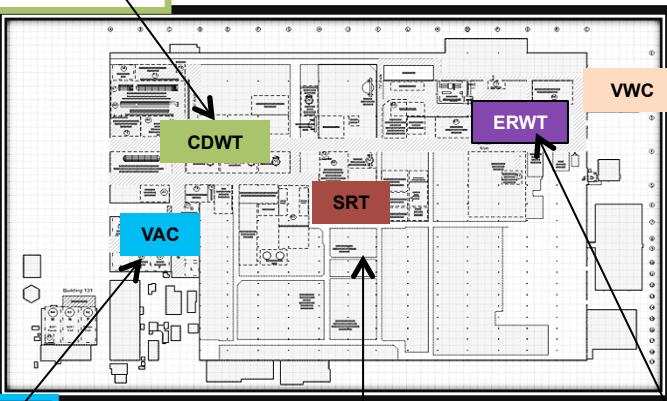
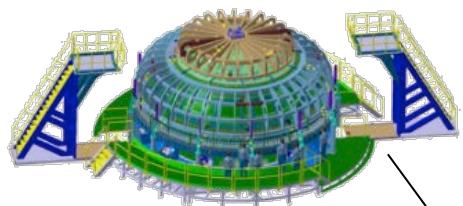
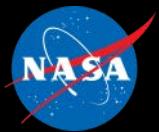
**System Requirements Review/System Definition Review Completed**

Qualification Motor 1 casting at  
ATK  
Oct 2012

# Michoud Assembly Facility (MAF), LA



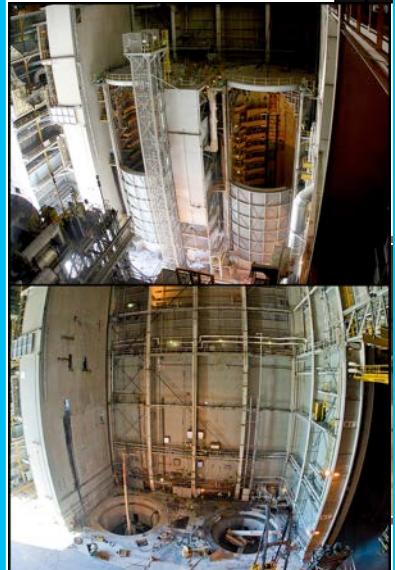
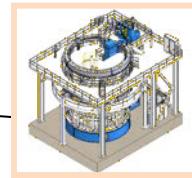
# Stages Manufacturing, Assembly, & Production/ Operations Snapshot at MAF



## Next Big Step

Tooling  
Availability

May- Enhanced Robotic Weld Tool (ERWT)  
June- Vertical Weld Center (VWC)



# Stages “Green Run” Test Buildup at SSC B-2



Stage is  
211" Tall

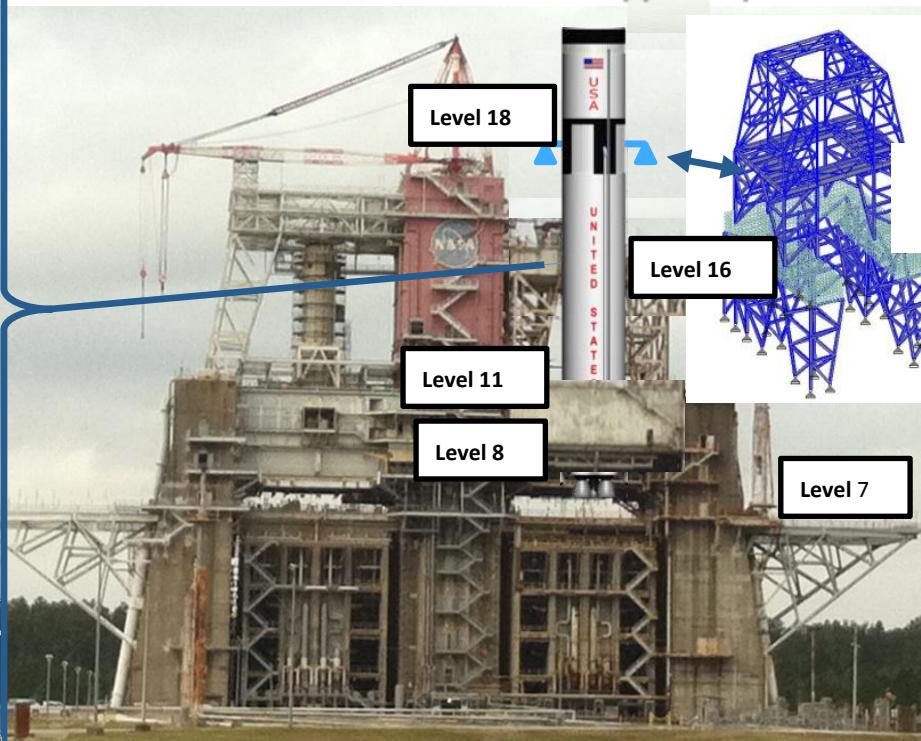


## Next Big Step

### Stage Testing

April 30% Design on Structural Build- Out & Electrical  
Restoration  
June Work Package 3 of 5 Awarded

### Upper Superstructure



NASA Stennis Space Center, MS  
Test Stand B-2 Stages Green Run



Level 7 Side after Demo  
& LOX Transfer Line



Above: Aspirator and  
Level 7 Demolition

Left: B-2 Flame  
Deflector Flow Testing

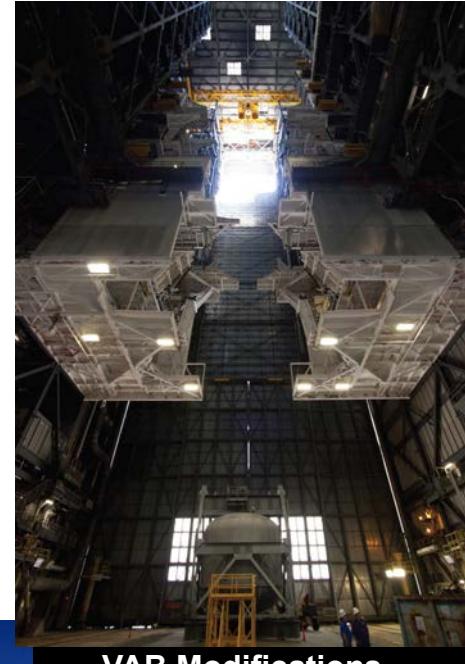
# GSDO Accomplishments



Crawler-transporter Modifications



Crawlerway Modifications



VAB Modifications



Pad 39B Modifications including new hydraulic elevators



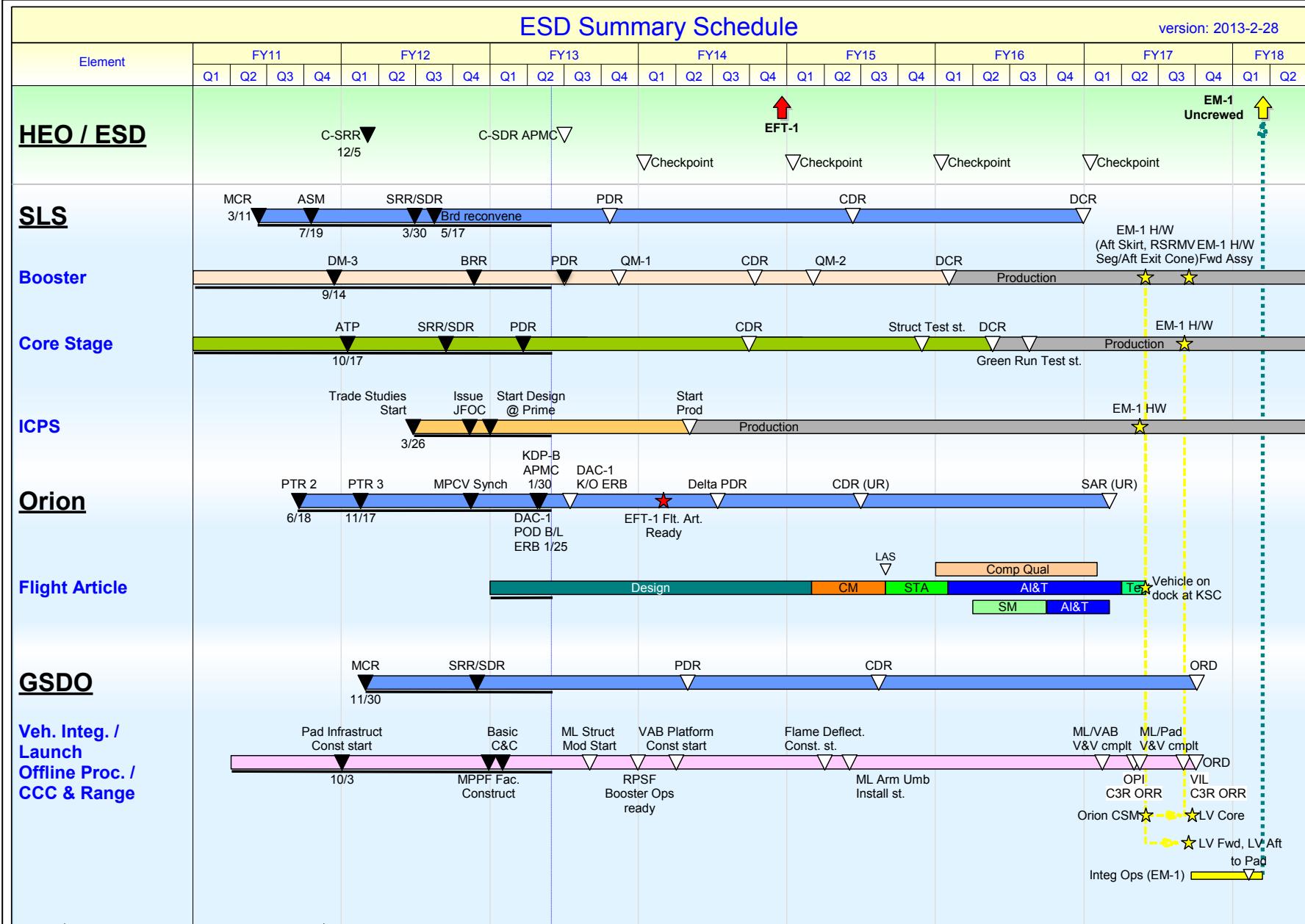
Testing of Crawler-Transporter 2



Pad 39B new interface connections

# ESD Summary Schedule

version: 2013-2-28



EFT-1 ft/hw

EM-1 ft/hw

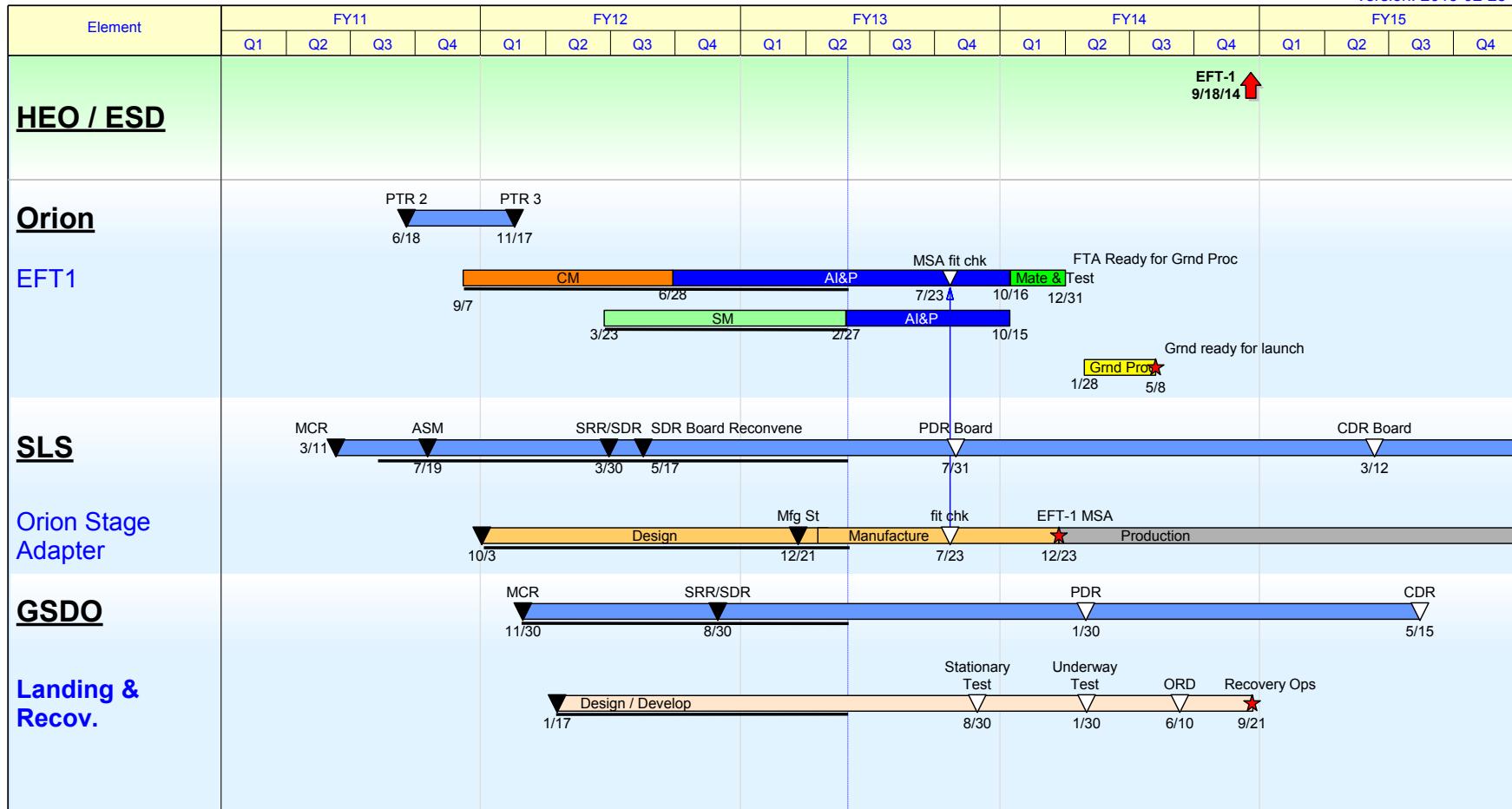
Progress to date

Milestones are "complete" unless noted

For comments contact david.l.webster@nasa.gov

# ESD EFT-1 PPBE14 Integrated Schedule

version: 2013-02-28



 Element tests

 EFT-1 Flt h/w

Milestones are "complete" milestones unless noted



# EFT-1 Update



# Heatshield Arrival at Textron

- Heatshield transport and unpacking complete



# Service Module Shear Web Assembly Installation



# Service Module Available

## Service Module Bulkhead Alignment / Fit Check



# Separation Test Fairing Status

## SAJ Fairing Panel 3, Removal From Sep Test Tool



# Separation Test Fairing Status: SAJ Fairing Panels in Preparation for May Sep Test



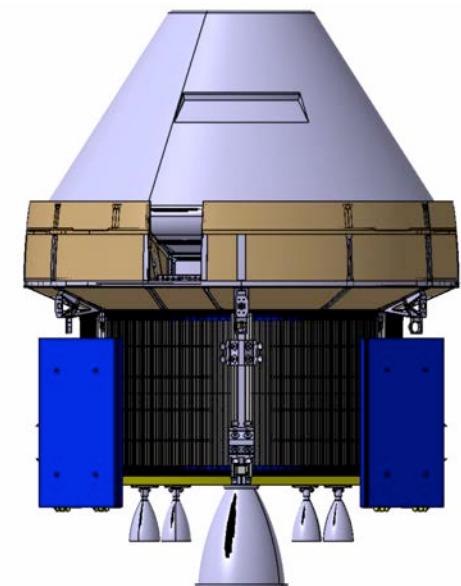


# ESA Service Module

# Orion Service Module/ESA Partnership

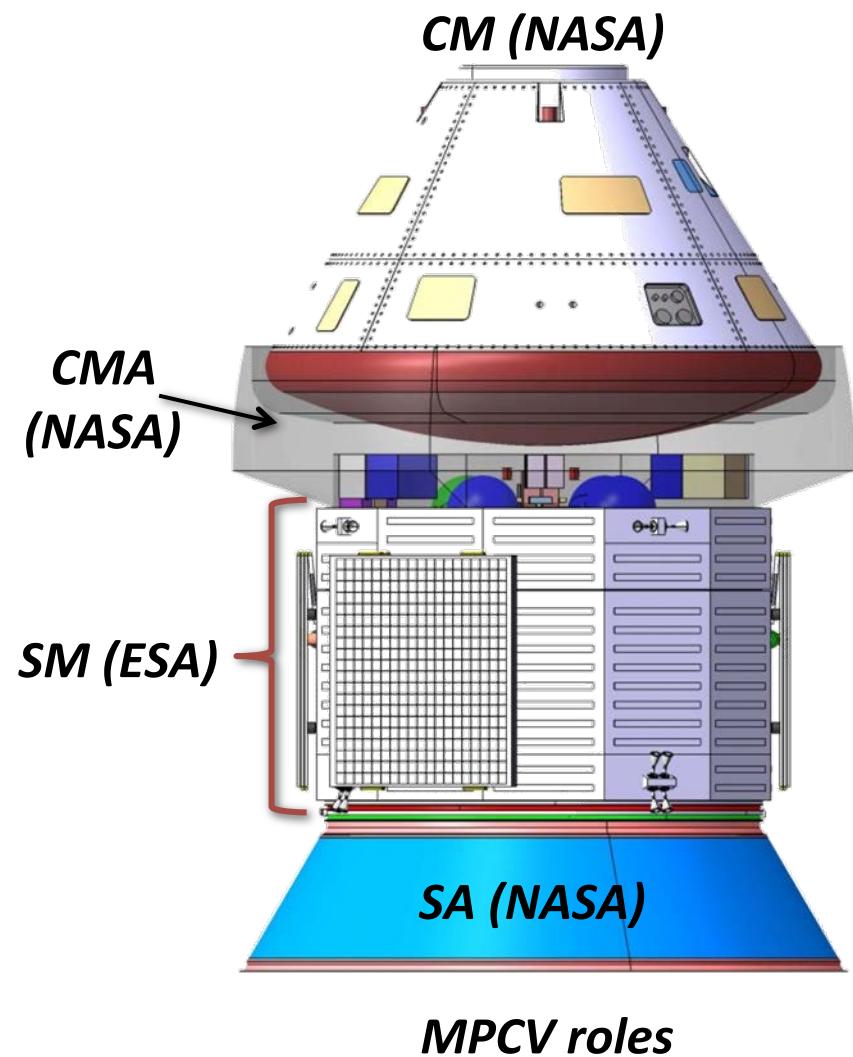


- NASA signed an agreement in December 2012 for the European Space Agency (ESA) to provide a service module for the Orion spacecraft's Exploration Mission-1 in 2017.
- The agreement primarily maps out a plan for ESA to fulfill its share of operational costs and additional supporting services for the International Space Station by providing the Orion service module and necessary elements of its design for NASA's Exploration Mission-1 in 2017.
- The service module will:
  - house power, thermal and propulsion systems
  - contain in-space propulsion capability for orbital transfer, attitude control and high-altitude ascent aborts
  - generate and store power and provide thermal control, water and air for the astronauts
  - remain connected to the crew module until just before the capsule returns to Earth



# ESA Service Module Overview

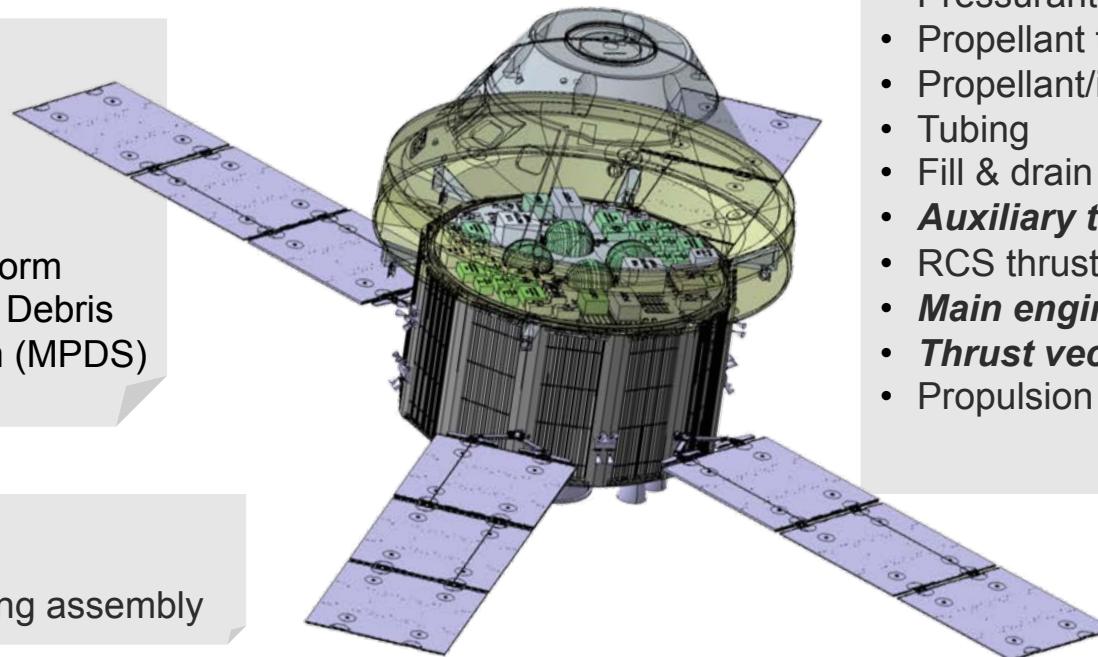
- The Crew Module (CM) and SM will physically interface via an interface ring called the Crew Module Adapter (CMA).
- The SM and CMA is attached to the CM from launch until just prior to the entry interface.
- NASA will be responsible for the CM, CMA, Spacecraft Adapter & Separation Mechanism (SA), SAJ (jettisonable fairings), and the Launch Abort System.
- ESA will be responsible for the SM consisting of:
  - Load bearing primary structure
  - Gas and water consumable storage tanks
  - 2 coolant loop 24 m<sup>2</sup> fluid radiators
  - 4 Solar Arrays
  - Propulsion subsystem based on:
    - Orbital Maneuvering System Engine (OMS-E), 8 Auxiliary thrusters, 24 Reaction Control Systems thrusters
    - 4 propellant tanks + 2 Helium pressurization tanks



# ESA SM Reference Configuration

## Structure

- Upper cylinder
- Tank platform
- Main cylinder
- Lower platform
- Equipment platform
- Micrometeoroid Debris Protection System (MPDS)



## Solar Generator

- **Solar cells**
- Solar array wing assembly

## Solar array drive assembly

- Solar array drive mechanism
- Solar array drive electronics

## SM Harness

## Electrical Power

- Power control & distribution unit

## Propulsion

- Pressure control assembly
- Pressurant tanks
- Propellant tanks
- Propellant/isolation system
- Tubing
- Fill & drain valves
- **Auxiliary thrusters**
- RCS thrusters
- **Main engine**
- **Thrust vector control**
- Propulsion drive electronics

## Data Management

- Command & management unit
- **Network Interface Cards**

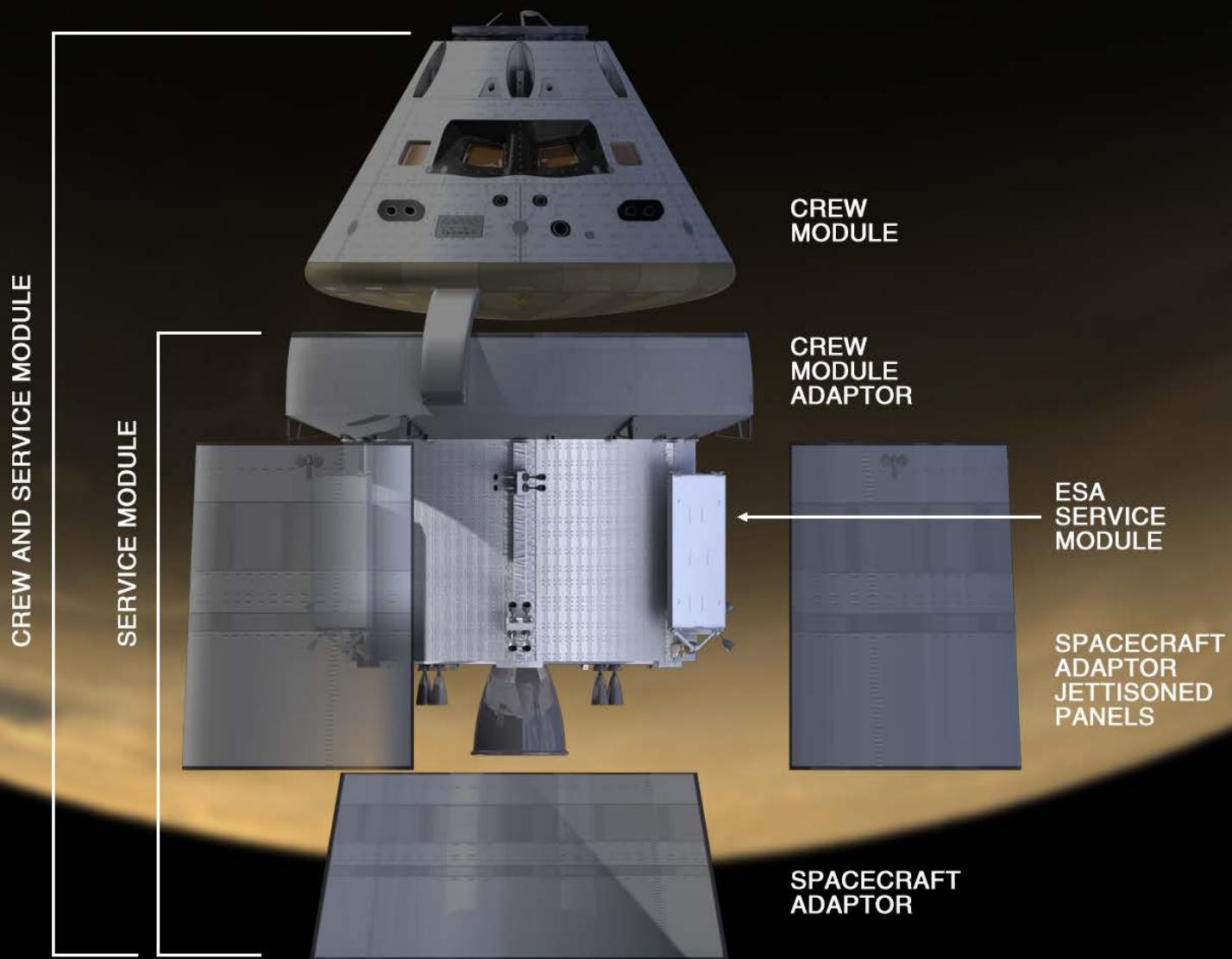
## Thermal Control

- Passive thermal control
- Active thermal control
- Thermal control unit

## Consumable Storage

- Water delivery system
- Gas delivery system

Note: Items in bold italic are the agreed to NASA contributions to the ESA SM



# Summary



- NASA continues to make great progress with SLS, Orion and GSDO
  - SLS PDR planned for summer 2013
  - GSDO preparing for PDR early 2014
  - Orion on track for EFT-1 in 2014
- SLS, Orion, and GSDO programs remain on track for 2017



Watch the Exploration Systems Development Division Quarterly at  
[http://www.nasa.gov/multimedia/videogallery/index.html?media\\_id=161836271](http://www.nasa.gov/multimedia/videogallery/index.html?media_id=161836271)